

REMARKS

Claims 1, 2, 5-10, 12, 13, and 15-38 are pending in the application. Claims 3, 4, 11, and 14 are cancelled. Claims 1, 12, 15, 18, and 29 are currently amended. Claims 5-8, 19-21, 30-32, and 34-37 are withdrawn. Applicants respectfully request for allowance of all pending claims based on following discussions.

Claim Objections

Claims 12 and 18 are objected to for certain informalities. In response, claim 12 is amended by replacing the phrase “axially move the actuator relative to the stator **with** rotation of the drive shaft” with “axially move the actuator relative to the stator **by** rotation of the drive shaft.” Claim 18 is amended by replacing the phrase “**a second** bearing assembly” with “**another** bearing assembly.” Accordingly, Applicants respectfully request that the objections against claims 12 and 18 be withdrawn.

Claim Rejections under 35 USC 112

Claim 29 is rejected, because the phrase “at least part of each rotor has an outer diameter that tapers decreasingly” is unclear. In response, claim 29 is amended, and now reads “[t]he pump according to claim 1, wherein at least part of each rotor tapers in a manner where an outer diameter of the at least part of each rotor decreases in a direction from a pump inlet to a pump outlet.” Accordingly, Applicants respectfully request that the rejection against claim 29 be withdrawn.

Claim Rejections under 35 USC 103

Claim 1

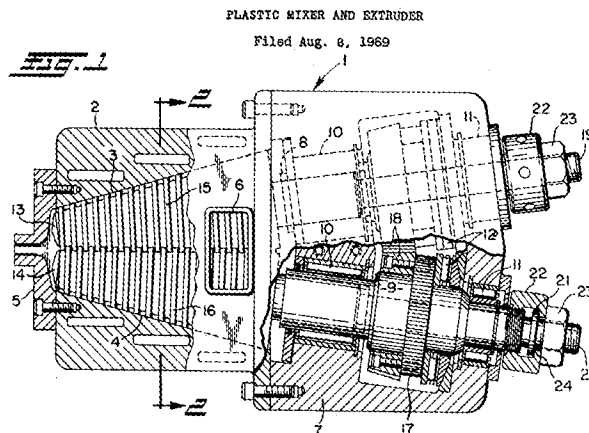
An exemplary embodiment of the claimed invention can be understood with reference to FIG. 8. As shown in the drawing, the rotors 92 and 94 are mounted on shafts 80 and 82, respectively, and rotatably supported by



the bearing assembly 86. A motor 100 drives a lead screw 102, which in turn moves a bearing housing 88 supporting the bearing assembly 86 in an axial direction. As such, the rotors 92 and 94 always move in sync without any relative movement therebetween in the axial direction.

1. *None of the cited prior art references teaches or suggests the claim limitation “the means drives the bearing assembly in a manner where the first and second rotors always move in sync without any relative movement therebetween in an axial direction.”*

McCormick teaches a plastic mixer and extruder having two separately adjustable screws that enable adjustment of the degree of mixing of materials. *See, col. 1, lines 12-18.* As shown in FIG. 1 of McCormick, when it is desired to increase the leakage flow, the lock nuts 23 are loosened and the nuts 22 are turned to move the flanges 24 away from the thrust collars 21 and upon retightening of the lock nuts 23, the screws 13 and 14 will be pull rearwardly until the thrust collars 21 are engaged with the respective flanges 24. *See, col. 2, lines 29-34.*



It is clear that the screws 13 and 14 are separately adjustable and do not always move in sync without any relative movement therebetween in an axial direction. There is no mechanism in place that ensures the tightening and loosening of both lock nuts 23 to occur simultaneously. In the event where the lock nut 23 for the screw 13 is loosened

and the lock nut 23 for the screw 14 is not, the screw 13 would be able to move relatively to the screw 14 in the axial direction. In such scenario, the screws 13 and 14 do not move in sync.

Shaw teaches a compressor having a male rotor 12 driving two female rotors 14 and 16. A stepper motor 360 is supported in an upper recess 362 and coupled to the female rotor 14 via an actuator block 366, drive shaft 372, pins 376 and bearing 300. *See, col. 6, lines 42-53.* Likewise, another stepper motor 380 is supported in an upper recess 382 and coupled to the female rotor 16 via an actuator block 384, drive shaft 390, pins 394, and bearing 306. *See, col. 6, lines 54-65.*

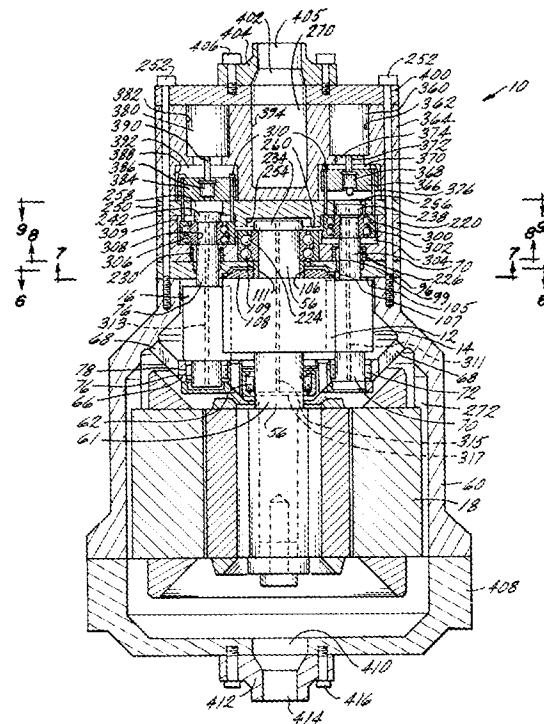


FIG. 3

The stepper motors 360 and 380 move the female rotors 14 and 16 in an axial direction, respectively and separately. The female rotor 14 as shown in FIG. 3 is in a fully loaded position with the stepper motor 360 in a retracted position. *See, col. 6, lines 50-53.* The female rotor 16 as shown in FIG. 3 is in a fully unloaded position with the stepper motor 380 in an extended position. *See, col. 6, lines 62-65.* It is clear that the female rotors 14 and 16 do not always move in sync.

It is noted that Examiner acknowledges “Fang et al. does not disclose means for effecting axial movement of the rotors as claimed in accordance with invoked 112 6th paragraph to vary a clearance between the rotors and the stator.” *See, the Office Action, paragraph 17.*

2. *It would not have been obvious for a person skilled in the art to modify McCormick or Shaw by providing a bearing assembly that is driven in a manner where two separate rotors always move in sync without any relative movement therebetween in an axial direction.*

In McCormick, the extruder is configured to keep the bearings 10, 11, and 12 stationary, while allowing the screws 13 and 14 to move relative to the bearings 10, 11, and 12 in an axial direction. This substantially differs from the claimed invention in which the rotors are supported by the bearing assembly, such that as the bearing assembly moves in an axial direction, the rotors move in sync in the same direction. Modifying McCormick into the claimed invention would require a complete redesign of the positions of the bearings 10, 11, and 12 with respect to the screws 13 and 14. Moreover, the mechanism, such as the lock nuts 23, nuts 22 and thrust collars 21, that enables the screws 13 and 14 to be moved separately is inherently incompatible with a design that moves the screws 13 and 14 in sync. Modifying McCormick into the claimed invention would require a complete redesign of such mechanism.

McCormick fails to suggest or imply the need for the screws to move always in sync in the axial direction. McCormick’s extruder is for mixing plastic materials, which does not require the screws 13 and 14 to rotate at a speed as high as a vacuum pump used in a semiconductor manufacturing process. Thus, there is a low risk for a disastrous clash

between the screws 13 and 14, even if they do not always move in sync in the axial direction.

In determining the propriety of the Patent Office case for obviousness in the first instance, it is necessary to ascertain whether or not the reference teaching would appear to be sufficient for one of ordinary skill in the relevant art having the reference before him to make the proposed modification. *In re Linter*, 458 F.2d 1013, 1016 (CCPA 1972). Given the lack of suggestion found in McCormick for the modification and the substantial redesign required by the modification, Applicants respectfully submit that it would not have been obvious for a person skilled in the art to modify McCormick by providing a bearing assembly that is driven in a manner where two separate rotors always move in sync without any relative movement therebetween in an axial direction.

With regard to Shaw, it is important that the female rotors 14 and 16 move separately in the axial direction in order to adjust the compression capacity at various degrees. *See, col. 5 line 55 – col. 7 line 9*. Shaw teaches away from a modification where the female rotors 14 and 16 move in sync in the axial direction, because doing so would render the compression capacity less variable. The totality of the prior art must be considered, and proceeding contrary to accepted wisdom in the art is evidence of nonobviousness. *In re Hedges*, 783 F.2d 1038 (Fed. Cir. 1986). Thus, Applicants respectfully submit that it would not have been obvious for a person skilled in the art to modify Shaw by providing a bearing assembly that is driven in a manner where two separate rotors always move in sync without any relative movement therebetween in an axial direction.

For the reasons discussed above, Applicants respectfully submit that claim 1 is patentable over Fang in view of McCormick and Shaw under 35 USC 103(a).

Claims 2-4, 9-18, 22-29, 33, and 38

Claims 2-4, 9-18, 22-29, 33, and 38 are rejected as unpatentable over Fang in view of McCormick, Shaw and other prior art references.

If an independent claim is nonobvious under 35 USC 103, then any claim dependent therefrom is nonobvious. *In re Fine*, 837 F.2d 1071 (Fed. Cir. 1988). As discussed above, Applicants respectfully contends that claim 1 is patentable over Fang in view of McCormick and Shaw under 35 USC 103(a). Accordingly, Claims 2, 9-10, 12, 13, 15-18, 22-29, 33, and 38 that depend from claim 1 and include all the limitations recited therein are also patentable over Fang in view of McCormick, Shaw and other prior art references under 35 USC 103(a). It is noted that claims 3, 4, 11, and 14 are cancelled.

CONCLUSION

Applicants have made an earnest attempt to place this application in an allowable form. In view of the foregoing remarks, it is respectfully submitted that the pending, elected claims are drawn to a novel subject matter, patentably distinguishable over the prior art of record. Examiner is therefore, respectfully requested to reconsider and withdraw the outstanding rejections.

Should Examiner deem that any further clarification is desirable, Examiner is invited to telephone the undersigned at the below listed telephone number.

Applicants do not believe that any additional fee is due, but as a precaution, the Commissioner is hereby authorized to charge any additional fee to deposit account number 50-4244.

Respectfully submitted,

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